In a paper read at the last meeting of the Statistical Society, by Mr. R. Price Williams, C.E., "On the Increase of Population in England and Wales," the author said the total increase of the population of England and Wales during the whole of the last century was only 3,417,536, the average decennial rate of increase being nearly 5 per cent., whereas during the present century, up to 1871, there was an increase of nearly 14 millions, the average decennial rate of increase being over 14 per cent. The rate of increase in the decade 1811-21 was the maximum attained in this century, viz., 18 per cent., as from that period down to the census of 1861 the rate of increase of the population had continuously diminished. He observed that a great increase of the population took place at the time when steam-power began to be used for manufacturing purposes, and while the towns increased, the rural districts were found to diminish. Mr. Williams estimates that the population of England and Wales by the census of 1881, will be 25,735,900. In the case of the population of London the decrements were very slight indeed, showing that it had not reached that declining stage in the rate of its increase long since arrived at in the case of Liverpool, Manchester, and many other large towns. The population of London had increased from 958,863 in 1801 to 3,251,913 in 1871. He did not think there was sufficient data for estimating the future increase of the population of London for any lengthened period, and he regarded as unreliable the enormous estimates which had recently appeared in connection with the question of the water supply of the metropolis, where the population in the course of the next century was estimated at over 17 millions.

The Thirteenth Annual *Report* of the Peabody Institute of Baltimore testifies to the increasing usefulness of that institution, both as a library and as a centre of varied instruction. Among its means of usefulness are a series of lectures, many of which are on scientific subjects.

We have received the *Report* of the South African Museum for 1879, from which we are pleased to see that the Museum is in a fairly flourishing condition. A long list of additions during the year is appended.

The May and June numbers of the Friends' Schools' *Natural History Journal* contain much interesting matter, the local papers being specially valuable.

The additions to the Zoological Society's Gardens during the past week include an Arabian Gazelle (*Gazella arabica*) from Arabia, presented by Capt. Titus; a Common Genet (*Genetta vulgaris*), South European, presented by Mr. G. H. Thunder, R.N.; an Emu (*Dromæus novæ-hollandiæ*) from Australia, presented by Mr. A. McIlwraith, F.Z.S.; a Greater White-crested Cockatoo (*Cacatua cristata*) from Moluccas, presented by Mrs. A. L. Chetwode; three Red-beaked Weaver Birds (*Quelea sanguinirostris*) from West Africa, presented by the Marchioness of Westminster; a Crested Ground Parrakeet (*Calopsitta novæ-hollandiæ*) from Australia, presented by Miss M. S. Spooner; a Barbary Ape (*Macacus inuus*) from North Africa, an Ocellated Monitor (*Monitor ocellata*) from West Africa, deposited; three Ruddy Sheldrakes (*Tadorna rutila*), European, two Sandwich Island Geese (*Bernicla sandvicensis*) from the Sandwich Islands, two Blood-rumped Parrakeets (*Psephotus hæmatonotus*) from Australia, two Celebean Rails (*Rallus celebensis*) from Celebes, purchased; a Collared Fruit Bat (*Cynonycteris collaris*), a Japanese Deer (*Cervus sika*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

The Third Comet of 1822.—Neither Galle in his catalogue, nor Karl in his *Repertorium der Cometen-Astronomie*, refers to any observations of this comet except the imperfect ones made by Caturegli at Bologna, and two by Gambart at Marseilles, and the only orbits found in the catalogues are the two calculated by Heiligenstein. The comet was however observed at Rio de Janeiro, from June 18 to June 24, and Henderson reduced the observations, which were made by Lieut. Robertson, R.N., and calculated an approximate orbit upon them. The comet approached near to the earth, and is of some interest upon that account. Mr. Hind has combined the observations of both hemispheres, and with the following results for the elements of the orbit: Henderson's numbers, not being found in our catalogues, are annexed:—

	Hind.	Henderson.
Perihelion passage	July 15·8442 G.M.T. ...	July 15·651 G.M.T.
Long. of perihelion	219° 59′·4 ...	220° 19′ 49″
,, Ascending node	97 44·3 ...	98 14 47
Inclination of orbit	36 17·5 ...	35 36 0
Log. perihelion distance ...	9·92797 ...	9·92879

Motion—retrograde.

Henderson's paper upon this comet will be found in the *Philosophical Transactions* for 1831. On June 18 the comet was in opposition to the sun, distant from the earth 0·14. Though it was discovered by Pons at Marlia on May 30, we have no observation previous to June 8. Pons at the time was not provided with instruments competent to fix the positions. Zach writes of the comet at the time of discovery that it was without tail or nucleus, simply a nebulosity more condensed towards the centre. Pons thought that in the absence of moonlight it would have been visible without the telescope. He was then on the watch for Encke's comet, which, though not observed in Europe, was closely followed by Rümker at Paramatta, N.S.W.

The Double-star 85 Pegasi.—Mr. Burnham publishes measures of the small and close companion of this star made in the summer of 1879, which, compared with those he obtained the previous year when he detected this very faint object, establish its physical relation to the principal star, since it is shown to partake of its large proper motion, while a suspicious difference of 10° between the means of the measures in 1878 and 1879 points to its binary character. These means are as follow:—

1878·43 ...	Position 274·0 ...	Distance 0″·67 ...	3 nights
1879·46 ...	,, 284·6 ...	,, 0″·75 ...	5 nights

Mr. Burnham estimates the magnitude of the close companion about the twelfth on Struve's scale, and considers it will require an aperture of at least twelve inches to show it. He has also measured the distant companion which was used by Prof. Brünnow in his investigation of the parallax of 85 Pegasi, which he made to be 0″·054. This star was observed with 85 at Königsberg by Bessel on October 6, 1825, when it followed 61″·95 in R.A., and was 38″·6 south of the bright star. If we compare these differences with those corresponding to Mr. Burnham's measures at the epoch 1878·95, and assume the fixity of the companion, we shall find for the secular proper motion of 85 Pegasi in R.A. + 100″·1, and in Decl. − 96″·1, agreeing precisely with the values resulting from a comparison of the meridian observations. If, as Prof. Brünnow hinted, there is proper motion of the distant companion, its amount would appear to be very minute. Mr. Burnham adds that there are but two other stars on our lists similar in character to 85 Pegasi, viz., η Piscium and β Scorpii; all three were detected by him with the 18-inch Chicago refractor.

A Variable Star in Aquarius.—The star observed on six nights at Bonn, in 1863, in R.A. 22h. 28m. 16·9s. N.P.D. 98° 21′ 19″ for 1855·0, is variable from 9m. to invisibility in a 7-inch aperture. Argelander noted it four times 9·5, once 9·6, and once 10·0. It was observed at Markree as a 9m. on October 27, 1848, on August 26, 1852, it was 11m., and on November 9, 1874, it was invisible. On September 21, 1876, it was 11·12. It has at times a hazy blurred appearance, as remarked in several other variable stars. This star was long since indicated as variable, but appears to have escaped attention from most observers of this class of objects.

GEOGRAPHICAL NOTES

Dr. Francisco Pereira Passos, Director of the Brazilian State Railways, has recently caused to be prepared and published a map showing the existing and projected railways in the provinces of Rio de Janeiro, Minas, and San Paulo. This map is

apparently executed with much care, and is stated to be the most accurate of its kind yet produced in Brazil. He has also published the first part of a work on the railways of Brazil in 1879, descriptive of the lines shown on the above-mentioned map, and he has added a skeleton map showing the railways only. Dr. Passos has, we believe, been induced to issue these publications in order to make more widely known in England the progress in railway communication now going on in Brazil, a subject which is of considerable interest from an economical and geographical point of view.

THE last *Bulletin* of the Antwerp Geographical Society contains a geographical and commercial essay on the Australian colonies, which is accompanied by reproductions of some curious old maps, as well as by a sketch map which professes to distinguish the arable, pastoral, and desert regions of the continent, in regard to which, however, the writer's information hardly appears to be brought down to the latest date.

FROM the Japan papers we learn that H.M.'s surveying vessel *Sylvia* left Hiogo on April 24 for Cape Chichakoff to take a line of soundings there, which will complete her surveying work on the Japanese coast. The *Sylvia* has been employed for about twelve years in surveying the coasts of Japan and the Inland Sea, and during this period has done excellent service to navigation.

M. DE UJFALVY is to leave Paris at the end of the summer on his new journey of exploration in Central Asia.

THE *Times* correspondent writes from Copenhagen that on June 24 died there Mr. Carl Petersen, whose name is connected with some of the most renowned Arctic explorations. He was a born Dane, but had lived many years in Greenland, and had there acquired a perfect knowledge of the Esquimaux language, being at the same time a most skilled hunter and fisherman. At the age of thirty-seven he was engaged by Capt. Penny as interpreter, and accompanied his expedition in the years 1850-51. Some years later he followed Dr. Kane on his unfortunate expedition, when the vessel had to be left in the ice and the crew were nearly starved and frozen to death. He had not been home more than a couple of weeks after returning from a two years' stay in Greenland, before he went out again as interpreter with the *Fox*, Capt. Sir Leopold M'Clintock, with Mr. (now Sir) Allan Young as sailing master. Of this expedition, lasting from 1857 to 1859, and leading to the discovery of the fate of Sir John Franklin, he has written a graphic description, supplying many details wanting in the well-known book of Sir L. M'Clintock, and inscribed with the words chosen by Jane Franklin for the flag of the *Fox*, "Hold fast," happening to be quite as correct in Danish as in English. In 1861 he accompanied the Swedish naturalists Nordenskjöld and Torell on their first expedition to Spitzbergen, and when, in last April, the *Vega* passed Copenhagen, the hardy old sportsman and sailor, with his cross and Arctic medal, was one of the friendly faces greeting the discoverer of the North-East Passage. Mr. Petersen died from heart-disease at the age of sixty-seven.

PHYSICAL NOTES

ONE of our electrical contemporaries across the Channel gives a glowing description of *une grande machine électrique allemande*, which its editor says he wishes to see introduced into France, "where our official professors appear to have lost all ambition at making things big." The great gooseberry of the season is nothing to this new machine, which is, we are told, composed of twenty parallel disks of 1,300 metres in radius. This is "making things big" with a vengeance, for the diameter of the disks will be over 2½ kilometres, or about a mile and a half. Did our contemporary make a double blunder when it wrote "*treize cents mètres*"? If we remember rightly, the plates in Töpler's induction-machine, which appears to be the one referred to, are not far from 13 centimetres radius.

PROFESSORS BRACKETT AND YOUNG have made a new determination of the efficiency of Edison's dynamo-electric generator and of his carbon horse-shoe lamp, and find that one horse-power applied at the dynanometer would produce in this lamp a light equal to that of 107 standard candles. As a matter of fact the lamp was only giving a light of 10·7 candles while consuming 0·077 of a horse-power, which is not quite the same thing.

PROF. QUINCKE has lately been occupied with a very remarkable research on the alteration of volume which a dielectric experiences under the stress of an electric charge. In most cases the result of surface electrification is to produce a minute expansion, but one class of bodies—that of the fatty oils and resins—contracts under similar circumstances. Herr Quincke applies his measurements to explain the phenomena observed by Kerr of the double refraction of light exhibited by dielectric media when under electrostatic strain; and he shows that the optical effects in the two classes of media are opposite in character.

M. MOUCHET is continuing in Algeria the researches on the utilisation of solar heat which he began in the South of France. He employs, according to his recent communication to the *Comptes Rendus*, a mirror 3·8 metres in diameter to concentrate the rays of the sun upon a boiler of copper 5 millims. thick. Even on dull days the apparatus boils water under half an hour. M. Mouchet has employed his apparatus for the distillation of oils and essences, the boiling of linseed oil, and the sublimation of benzoic acid. He has even succeeded in working a small engine.

MR. G. R. CAREY of Boston has published in the *Scientific American* a suggested system for the transmission of light by electricity. A camera throws an image of the object to be exhibited upon a surface made up of small pieces of selenium, each of which forms part of a separate voltaic circuit, the circuits passing to a receiving instrument, where they reproduce the image by incandescence. To this Mr. Sawyer has appended the following criticisms:—The action of light in altering the conductivity of selenium is slow. To transmit satisfactorily an image one inch square would require 10,000 selenium points and 10,000 conducting wires, unless some principle of isochronous movement could be devised—which Mr. Sawyer regards as unattainable in practice.

M. FAYE has lately published in the *Comptes Rendus* a remarkable paper on the physical forces which have produced the present figure of the earth. After remarking on the use of the pendulum in determining the figure of the earth from series of measurements of the intensity and direction of the gravitation force at different parts of the earth's surface, he draws attention to the curious fact that while the direction and intensity of gravity are affected perceptibly by the presence of hills such as Schiehallion and Arthur's Seat, or even by masses as small as the Great Pyramid of Gizeh, gigantic mountains such as the Himalayas, and great elevated plateaux and table-lands do not affect the pendulum-indications in any sensible manner, except in certain cases where upon elevated continents there appears to be a veritable defect of attraction instead of the excess which might be expected. Indeed, the observations are sufficiently striking to seem to point to the supposition that not only under every great mountain, but even under the whole of every large continent, there were enormous cavities. More than this, the attraction at the surface of all the great oceans appear too great to agree with the distribution presumed by Clairant's formula, which is exact enough for most purposes. Sir G. Airy's suggestion that the base of the Himalaya range reaches down into the denser liquid interior, and there displaces a certain amount of that liquid, so that the exterior attraction is thereby lessened, is one which, inherently improbable, fails to have any application in explaining why the attraction above the seas should be greater than over the continents. M. Faye propounds the following solution to the difficulty:—*Under the oceans the globe cools more rapidly and to a greater depth than beneath the surface of the continents.* At a depth of 4,000 metres the ocean will still have a temperature not remote from 0° C., while at a similar depth beneath the earth's crust the temperature would be not far from 150° C. (allowing 33 metres in depth down for an increase of 1° in the internal temperature). If the earth had but one uniform rate of cooling all over it, it would be reasonable to assume that the solidified crust would have the same thickness and the same average density all over it. It is therefore argued that below the primitive oceans the earth's crust assumed a definite solid thickness before the continents, and that in contracting, these thicker portions exercised a pressure upon the fluid nucleus tending to elevate still further the continents. This hypothesis, M. Faye thinks, will moreover explain the unequal distribution of land and sea around the two poles; the general rise and fall of continents being determined by the excess of density of the crust below the oceans, and by the lines or points of least resistance to internal pressure being at the middle of continents or at the margin of the oceans.